



## National Energy Board

Report In the Matter of a Public Inquiry  
into an Accident at Kilometre-Post  
MLV 133-1 + 16.3 km, North of Oshawa,  
Ontario on the Pipeline System Owned  
and Operated by TransCanada Pipelines Limited

May 1986



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Conditions for Crossings of Pipelines  
(National Energy Board, 14 December 1978)

### **Recital and Appearances**

IN THE MATTER OF a public inquiry pursuant to Section 20 of the National Energy Board Act, into an Accident that occurred on 17 October 1985 at kilometre-post MLV 133-1 + 16.3 km, North of Oshawa, Ontario on the Trans-Canada PipeLines Limited system.

**HEARD** at Willowdale, Ontario on 15, 16, 17 and 18 April 1986.

#### **BEFORE:**

W.A. Scotland  
R.F. Brooks  
J. Farmer

Presiding Member  
Member  
Member

#### **APPEARANCES:**

T. McGrenere  
C.C. Black

TransCanada PipeLines Limited

B. Doherty

Mr. Roy Walker; and Family of the late Mr. Donald Wright

J. Pounder

Ontario Ministry of Energy

C. Lamb

on his own behalf

D. Inglis

Ontario Farm Drainage Association


H. Soudek

National Energy Board

## Abbreviations

<b>EDST</b>	Eastern Daylight Saving Time
<b>ft</b>	feet
<b>ha</b>	hectares
<b>in</b>	inches
<b>kPa</b>	kiloPascals
<b>m</b>	metres
<b>mm</b>	millimetres
<b>NEB, the Board</b>	National Energy Board
<b>psi</b>	pounds per square inch
<b>r.o.w.</b>	right of way
<b>TCPL</b>	TransCanada PipeLines Limited





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## Synopsis

On 17 October 1985, at approximately 1411 h EDST, Line 100-1 of TransCanada PipeLines Limited (TCPL) was accidentally ruptured by the blade of a 30 tonne self-propelled drainage tile plow working on a farm north of the City of Oshawa, in the Regional Municipality of Durham, Ontario. The escaping gas ignited resulting in an explosion and a fire which burned for approximately four hours. The operator of the plow died in the explosion and ensuing fire; three of his employees were burned but recovered, and one other person, a TCPL employee, was slightly injured.

Figure 1 shows the site of the accident where TCPL has two lines of high pressure pipe, one 508 mm (20 in) in diameter and the other, 610 mm (24 in). The maximum allowable operating pressure on each of these lines is 6 450 kPa (936 psi). They are buried to a depth of approximately 1 m (3.3 ft) to the top of the pipe within a right-of-way 18.3 m (60 ft) wide. The lines run roughly west to east and the smaller diameter line, 100-1, is the more northerly of the two, being some 6 m (20 ft) from the northern edge of the right-of-way at the site of the accident. The right-of-way at this location runs across the farm belonging to the Guy family, for whom the tile drainage work was being done.

The operator of the plow, and the person in charge of the tile work, was Mr. Donald Wright, a co-owner of the tile drainage company. He had with him a crew of three men: one to drive the truck which contained a reel of plastic tile, a second to operate a rubber-tired backhoe for digging at specific locations to make tile connections, plus a third as a helper.

Figure 1 also shows the planned work for 17 October, the day of the accident. It apparently included the laying of a run of 4-inch tile some 9 m north of Line 100-1 and parallel to it.

The following day, an actual crossing of the two lines of pipe was apparently to have been made by laying 6-inch tile across Lines 100-1 and 100-2.

On 16 October, the day prior to the commencement of the work, Mr. Wright had contacted TCPL requesting that the pipelines at the Guy farm be located. The next day, a TCPL employee, Mr. Burkholder, arrived on site at approximately 1320 h EDST, and, using an electromagnetic pipe locator, began locating and staking out the lines, starting with what he thought was the more northerly line, 100-1. The evidence indicates that, after completing the marking of one line, Mr. Burkholder told Mr. Wright that he had staked out the north line and Mr. Wright replied that he would come within 25 to 30 ft (approximately 8 to 9 m) of that line. Mr.

Burkholder then proceeded to try to locate the line that he believed to be to the south.

Prior to this conversation, Mr. Wright had already laid all the 6-inch tile he had at the time, proceeding from the north towards the presumed intended crossing of the pipelines. From this line of 6-inch tile, Mr. Wright then commenced laying 4-inch tile from the north, towards the pipeline right-of-way and roughly at right angles to it. The evidence indicates that Mr. Wright intended to stop his plow north of the pipeline right-of-way, at which point he would later connect with the tile to be laid parallel to the pipeline and just north of the right-of-way.

It was later determined that the first line staked by Mr. Burkholder was not the north line, i.e., the one closer to the work area of the drainage contractor, but rather it was, in fact, the one some 9 m to the south. Therefore, as the plow was nearing the completion of the line of 4-inch tile, it was not some 9 m north of Line 100-1, as planned, but rather virtually on top of that line. After stopping to allow the tile to be cut off from the reel, Mr. Wright started to drive the machine forward to finish laying the tile and almost immediately its blade, not yet out of the ground, caught and ruptured Line 100-1.

The drainage tile plow was thrown some 11 m by the force of the escaping gas; in the explosion and ensuing fire, Mr. Wright was fatally burned. The driver of the nearby tile reel truck, Mr. Brasier, was severely burned as was Mr. Duff, the operator of a backhoe farther north of the immediate area of the break. The third member of the crew, Mr. Peeters, was also burned. TCPL's employee, Mr. Burkholder, who had been in the process of staking what he believed to be the south pipeline, was farther from the point of the actual rupture and received some minor burns. He assisted Mr. Brasier into his truck and drove to a point where he could alert the nearest TCPL station.

A more detailed description of the accident and related events, as the Board understands them, is given in Appendix A.

## The Accident Investigation

TCPL's system is under the regulatory jurisdiction of the National Energy Board. The Board carried out an investigation of the accident, culminating in a four-day public hearing in Willowdale beginning 15 April 1986. During the hearing, TCPL representatives gave detailed testimony on the events before, during and after the accident, on the Company's relevant rules and procedures and on its approach to protecting the integrity of its pipelines. Detailed information was provided by both TCPL and representatives of the late

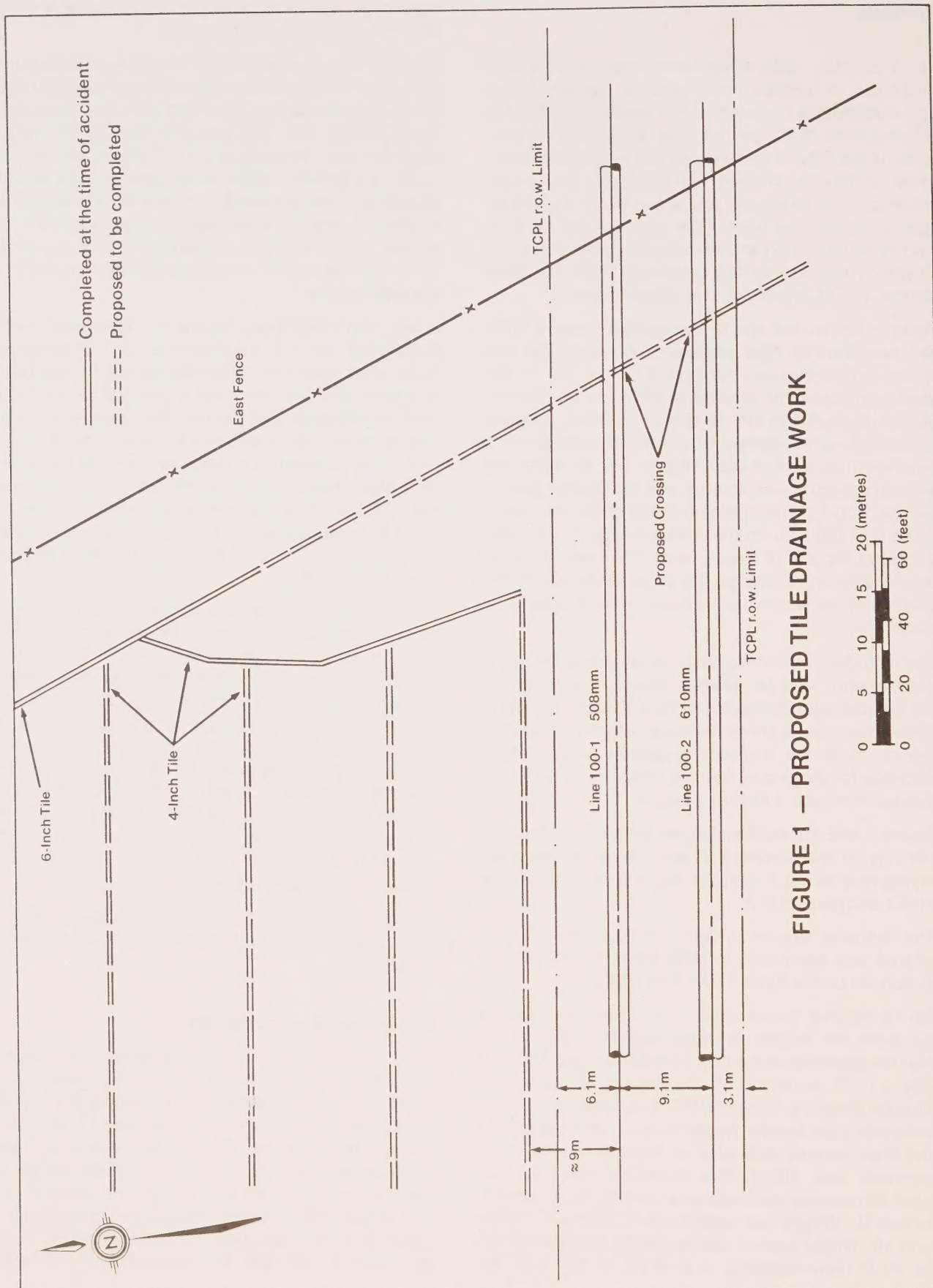


FIGURE 1 — PROPOSED TILE DRAINAGE WORK



Mr. Wright's firm on the practices employed to lay drainage tile near and across pipelines. Other parties assisted with supplementary information and recommendations. A list of parties participating in the hearing and their counsel and witnesses is given in Appendix B.

### Findings of the Board

There was considerable testimony at the inquiry concerning practices, procedures and instructions relevant to the crossing of pipelines, including recommendations for improvement. However, the fundamental cause of the accident was not, in the Board's view, a lack of instructions or procedures. There was no evidence to show that the methods generally followed by TCPL in locating buried facilities were deficient. In this particular case, there is no indication that the pipe locator malfunctioned. The inquiry did not uncover evidence of human inexperience or lack of training as significant factors. The tile drainage contractor was, from all indications, qualified, experienced and duly licensed. There was a breach of section 77 of the NEB Act and of the Board's General Order No. 2 (Appendix C) in that no application had been made to the Board for authorization to make a crossing of the pipeline. However, there was no evidence to show that, absent such breach, the accident would not have occurred.

The Board cannot but conclude that in this instance, as in so many others involving repetitive human activities, there was insufficient regard for established procedures and a relaxation of attentiveness born perhaps of Mr. Burkholder's familiarity with the work at hand. Recognizing this primary conclusion, the following particular factors are significant:

1. Mr. Burkholder staked the south line in the mistaken belief that it was the north line, i.e., the one nearest to the drainage tile work.
2. Mr. Burkholder informed Mr. Wright that the first staked line was the north line without first confirming it to be so by locating the second line.
3. Mr. Burkholder did not prevent the drainage tile crew from proceeding to work towards the pipeline right-of-way before both lines had been located and marked.
4. The oral communications between Messrs. Burkholder and Wright were not adequate to make Mr. Burkholder clearly aware of what Mr. Wright was doing and planning to do.
5. Mr. Burkholder did not continuously monitor the activities of Mr. Wright, even though the latter had stated that he would come to within 8 to 9 m of the staked line.

### Actions

Following the accident, TCPL, on its own initiative, examined its related instructions and training material. It has put into effect revised instructions covering the steps its employees should follow upon becoming aware of intended work near the Company's pipelines. It has also improved its training of employees in the use of the electromagnetic locator for buried pipelines. Efforts appear to have been made to re instill in the minds of TCPL employees the need for safety-related alertness. The Company has also recognized the need to put renewed emphasis on making the public, particularly those who may have to work near its pipelines, aware of the potential hazards and the procedures to deal with them.

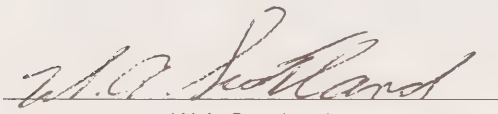
The Board is generally satisfied with TCPL's initial action in the wake of this accident. It will, however, require the Company to examine several questions and report thereon by 29 August 1986.

1. Recognizing that, when work is to be performed near a pipeline, there are two fundamental activities to be performed, the *locating and marking* of *all* pipelines in the right-of-way and the *monitoring* of *any and all* work taking place near the line, is there a need, either as a general rule or in particular cases, for more than one TCPL employee to be at work sites near pipelines?
2. Should the TCPL field employee(s) disallow, or at least discourage, any and all excavation work at least within a distance of, say, 30 m from the assumed location of a pipeline *until* all pipelines and the limits of a safety zone have been staked out?
3. Should TCPL develop and distribute a concise pamphlet on the safety practices to be followed by contractors in the vicinity of gas transmission lines?
4. Do TCPL's revised Code of Operating Practice documents emphasizing the need for advanced planning and documentation on tile drain crossings allow for sufficient response time by the pipeline company?
5. Has TCPL considered incorporating the relevant Company documents into one easily carried handbook, including a check list which could form the basis of the report to be prepared by its on-site personnel?

The Board has taken note of the issues raised and recommendations made by the Ontario Farm Drainage Association, Mr. Charles Lamb and the Ontario Ministry of Energy. To the extent possible, the Board has taken these issues and recommendations into account in this Report.

In addition to the foregoing matters, the accident and the ensuing investigation have raised issues of a more generic nature concerning the regulation of crossings of pipelines under NEB jurisdiction, and in particular, tile drainage crossings. This matter is generally covered by section 77 of the NEB Act and the Board's General Order No. 2. In light of the testimony given and the recommendations made at the public inquiry, the Board is examining the provisions of section 77 and of General Order No. 2.

The foregoing constitutes the findings and recommendations in the matter of the National Energy Board inquiry into the TCPL accident at Oshawa.



W.A. Scotland  
Presiding Member



R.F. Brooks  
Member



J. Farmer  
Member

Ottawa, Canada  
May 1986



# Appendix A

## The Accident Description and Related Events

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### NOTE:

*The detailed accident description presented in Appendix A is based solely on the evidence presented at the NEB public inquiry. To the best of the Board's knowledge, these are the events which took place on 16, 17 and 18 October 1985.*

On Wednesday, 16 October 1985, Mr. Donald Wright, a co-owner of Walker-Wright Drainage Limited, visited Compressor Station 134 of TransCanada PipeLines Limited (TCPL), located northeast of Oshawa, Ontario. At the station, Mr. Wright met with a TCPL employee named Fred Manssen. Mr. Wright advised Mr. Manssen that his firm would be performing a tile drain installation on an Oshawa-area farm owned by Mr. Norman Guy that would involve the crossing of TCPL's pipelines. The date given for the work was Friday, 18 October 1985. Mr. Wright requested that TransCanada personnel be available to do a pipeline "locate".

The location of the Guy farm is shown on the map comprising Figure A.1; its legal description is Lot 14, Concession VI, Regional Municipality of Durham, City of Oshawa. As shown on the map, the farm is traversed from west to east by two high pressure gas transmission pipelines owned and operated by TCPL: Line 100-1, 508 mm (20 in) in diameter and the other, Line 100-2, 610 mm (24 in) in diameter. The maximum allowable operating pressure for each pipeline is 6 450 kPa (936 psi). The two pipelines are buried to a depth of approximately 1 m (3.3 ft) within a right-of-way 18.3 m (60 ft) wide. At the line rupture site, also shown on the map, the line spacing is approximately 9 m (30 ft) with the more northerly pipeline, Line 100-1, being some 6 m (20 ft) from the north limit of the right-of-way.

Prior to Mr. Wright's departure from Station 134 on 16 October 1985, Mr. Manssen radioed a co-worker named Paul Burkholder, away on another assignment at the time, to inform him of Mr. Wright's request for a pipeline locate. Mr. Burkholder had worked with Walker-Wright Drainage Limited previously, including an occasion a year or so earlier when that firm had done some other tile drain work in a more northerly part of the Guy farm. On that particular occasion, a

pipeline locate was not required as the job site was remote from the TCPL right-of-way.

Upon his arrival at Station 134 some two hours later, Mr. Burkholder telephoned his supervisor, Mr. Roach, to inform him of the upcoming Walker-Wright job and the request for a pipeline locate. Mr. Roach was at TCPL's district office, situated at Compressor Station 130 near Maple, Ontario. Mr. Roach agreed to Mr. Burkholder being the TCPL representative on the Walker-Wright job and concurred with Mr. Burkholder's suggestion that he use the Metrotech Model 480 pipe locator on hand at Station 134 for the purpose of locating the pipelines.

After finishing their work at Station 134 at 1630 h EDST on Wednesday, Messrs. Burkholder and Manssen travelled together on their way home to Markham and Scarborough respectively. At that time, Mr. Manssen reiterated to Mr. Burkholder that the Walker-Wright job was scheduled for Friday, 18 October 1985. The two did not return to the district office at Maple that evening.

The following morning (Thursday, 17 October 1985), on their way to work back at Station 134, Messrs. Burkholder and Manssen stopped in at Mr. Guy's farm. Upon their arrival at 0745 h EDST, they found Mr. Guy at his barn, which is located near the southern extremity of his farm. Mr. Guy informed them that drainage pipes had been brought to his field, but that he did not know when the installation work was to commence. Messrs. Burkholder and Manssen then left the farm and continued on to Station 134, where they performed electrical work throughout the morning.

Messrs. Burkholder and Manssen were continuing with the electrical work when Mr. Wright arrived at the Station at 1215 h EDST. Mr. Wright informed them that his previous job had been completed earlier than anticipated and that he was then ready to proceed with the work at Mr. Guy's farm. For that reason, he requested that a locate be done that afternoon. The two TCPL employees were apparently receptive to his request and had him stay for coffee while they had lunch.

In the conversation that followed, the upcoming work at Mr. Guy's farm was discussed in general terms. Mr. Wright made known his intention to make a number of crossings of the TCPL pipelines, whereupon Mr. Burkholder expressed a preference to have the number of such crossings kept to a minimum. There was a general agreement at this time to restrict the number of crossings to one. With regard to scheduling, Mr. Wright indicated that the TCPL pipelines at the crossing site could probably be exposed that afternoon, but that the actual crossing would probably be done the following day, Friday, 18 October 1985.

Mr. Wright left Station 134 prior to Mr. Burkholder finishing his lunch and arrived at the job site at approximately 1245 h EDST. Already present at the site were Walker-Wright personnel Kevin Brasier, Graham Duff, Joseph Peeters, and Roy Walker. Those personnel had started arriving on site at approximately 1200 h EDST and had begun preparing for the job at hand. The major work equipment on site included a truck containing a reel of 4-inch plastic tile, a rubber-tired backhoe, and a 30 tonne self-propelled drainage tile plow.

Mr. Wright was to be the operator of the plow and the person in charge of the tile work. Under his supervision would be: Mr. Brasier, whose primary function would be to drive the tile reel truck; Mr. Duff, who would operate the backhoe for digging at specific locations to make tile connections; and Mr. Peeters, a helper. Mr. Walker, the other co-owner of Walker-Wright, had come to the work site and delivered the plow on a lo-boy tractor trailer. He left the site in the tractor trailer at approximately 1300 h EDST.

Mr. Burkholder arrived on site at approximately 1320 h EDST. He entered the Guy farm from County Road No. 3 (see Figure A.1), drove north along a lane adjacent to and east of the intermediate fence on Mr. Guy's property, and then turned right and headed east when he reached what he estimated to be the TCPL right-of-way. He parked his truck in the vicinity of the "TCPL VEHICLE TRACKS" marking on Figure A.2, a location roughly halfway between the intermediate and east fence lines (fence to fence spacing along right-of-way is approximately 225 m (750 ft)). In the absence of pipeline markers at either of those fence lines or points in between, Mr. Burkholder had estimated the location of the right-of-way by considering the tree line on the east side of the east fence line to coincide approximately with the north limit of the right-of-way (see Figure A.2).

Upon his arrival, Mr. Burkholder observed that Mr. Wright and his crew had commenced working to the northeast in the area of the "GALVANIZED HEADER" marking on Figure A.2, some 80 m (260 ft) north of the

TCPL right-of-way. This location is the low point in the field and, as such, was to serve as the location for the outlet of the proposed tile grid. The evidence indicates that, at this stage, ditching by backhoe had been essentially completed at that location in preparation for the installation of that outlet. The evidence also suggests that, at this time, Mr. Wright had commenced surveying the elevations on the north side of the field, working from east to west, using laser equipment.

Mr. Burkholder began the task of locating and marking the two TCPL pipelines. To do so, he had in his possession a Metrotech Model 480 pipe locator and seven stakes. Prior to commencing the line locating activity, battery checks were performed on both the receiver and transmitter portions of the locator; each battery displayed adequate voltage.

Mr. Burkholder then walked with his locating equipment to within some 15 m (50 ft) of the east fence. There, using the electromagnetic locator in the inductive mode, he proceeded north from what he estimated as the south limit of the right-of-way, getting two separate peak signals which he believed were indicative of each of the two pipelines. The evidence suggests that these two indication points were not staked or marked in any way by Mr. Burkholder. Then, apparently using the more northerly indication as a starting point, he commenced tracing what he believed to be the north pipeline, Line 100-1. In progressing westwards across the field towards the intermediate fence, he placed four stakes along the perceived location of Line 100-1, each stake being about 1.2 m (4 ft) in length and topped with red paint.

However, the evidence clearly demonstrates that Mr. Burkholder had, in fact, mistakenly staked the more southerly of the two pipelines, Line 100-2. As noted earlier, this line is located some 9 m (30 ft) south of Line 100-1.

At about the time Mr. Burkholder was staking the first line, the Walker-Wright crew was completing the installation of a run of 6-inch tile, approximately 65 m (215 ft) long, from the galvanized header southwards, towards the pipeline right-of-way. Mr. Burkholder, involved with his locating duties, was not fully aware of the work that was proceeding. The path of the 6-inch tile run, which terminated some 26 m (85 ft) north of the actual Line 100-1 location, is depicted in Figure A.2. The evidence indicates that this run used all of the 6-inch tile at the job site that day. It was apparently Mr. Wright's intention to have additional 6-inch tile on hand the next day to facilitate the extension of that run farther south and across the two TCPL pipelines (see Figure A.3).

In the belief that he had staked Line 100-1, Mr. Burkholder then proceeded to try to locate the second

line, which he assumed would be to the south. In the vicinity of the intermediate fence he began scanning with the locator areas both north and south of the first staked line. During the scanning a signal was detected some 9 m (30 ft) south of that line. That signal to the south was somewhat weaker than those received along the first staked line.

During the course of this second line search, Mr. Burkholder had two occasions to converse with Mr. Wright. In the first instance, Mr. Wright drove over to the intermediate fence in his truck. During the first conversation Mr. Burkholder noted to Mr. Wright that he was short of stakes. After finishing that initial conversation, Mr. Wright drove away and came back on foot some five minutes later. On this occasion, he had in his possession a number of stakes, some of which he gave to Mr. Burkholder.

In the course of those two conversations, Mr. Wright outlined his plans for the tile grid. The evidence suggests that Mr. Burkholder may not have fully understood the planned tile layout (as illustrated in Figure A.3). Mr. Burkholder did, however, gain the impression that:

- (i) the work would include the laying of tile parallel to and some 9 m (30 ft) north of the more northerly pipeline, Line 100-1; that tile was intended to be outside the TCPL easement; and
- (ii) there would be only one crossing of the pipelines which would occur at the east side of the field.

With regard to his immediate plans, Mr. Wright stated that he would be making some connections.

Mr. Burkholder informed Mr. Wright that the line he had staked was the north line but that he was having difficulty locating the second line. He gave Mr. Wright a warning to stay well back of the right-of-way.

Having finished conversing with Mr. Burkholder, Mr. Wright proceeded to place a line of stakes to the north of, and roughly at right angles to, the line that had been staked by Mr. Burkholder. This first line of stakes was placed near the intermediate fence, north of the area where the two men had conversed. The evidence is not clear whether a second line of stakes was placed nearer to the east fence line, approximately where the tile work had been done to that point. The evidence shows that six stakes were placed in the western line, the stakes being about 0.6 m (2.0 ft) in length and painted white. The stakes were placed at approximately 14 m (45 ft) intervals, with the southernmost stake being located some 9 m (30 ft) north of Mr. Burkholder's staked line. As a result, the southernmost stake (or stakes) was virtually on top of the actual Line 100-1 location. Mr. Burkholder had noticed

Mr. Wright starting to place stakes near the intermediate fence line, but was not aware of the placing of the stakes near the east fence line. No stakes were found near the east fence line. However, the remains of one stake was found on the western edge of the crater as indicated on Figure A.2.

The evidence established that these stakes were placed to indicate the spacing and alignment of planned 4-inch tile runs that would extend across the field in a west-east fashion, parallel to the two TCPL pipelines. These 4-inch "laterals" would serve to collect water and to transport it in an eastward direction. At the east side of the field, these laterals would connect into headers that would divert the flow to the north and through the outlet into the natural watercourse. Those laterals closest to the pipelines would connect into a 4-inch tile "sub-header", which was yet to be run in. This 4-inch sub-header, as well as the 4-inch laterals more remote from the pipelines, would connect into the 6-inch header that had already been laid. As noted previously, that 6-inch header was apparently to be extended across the pipelines the following day and would also transport drainage water from the field south of the pipelines. The planned tile network is illustrated in Figure A.3.

By the time Mr. Wright finished his staking, Mr. Duff, the backhoe operator, had completed an excavation to facilitate the connection of the planned 4-inch sub-header to the partially-installed 6-inch header. This tile junction is marked as the "Y-CONNECTION" on Figure A.2, and is located some 38 m (125 ft) north of the actual Line 100-1 location. Once the 4-inch tile was connected at this location, Mr. Wright proceeded to plow in the 4-inch sub-header in a southerly direction, staying east at all times of the one stake that he had placed in that part of the field. The tile reel truck, being driven by Mr. Brasier, was beside and to the west of the plow. It moved south in tandem with the plow and continuously fed the 4-inch tile into the tile shoe of the plow (see Fig. A.4. for a schematic drawing of the plow). The tile was being laid at an approximate depth of 1.0 to 1.2 m (3.5 to 4.0 ft).

The apparent intention of Mr. Wright was to lay the 4-inch sub-header as far as his southernmost stake, and then to connect and run the 4-inch laterals parallel to the pipelines, starting with the one to go along the line of the two southernmost stakes. However, as noted earlier, those two southernmost stakes were virtually on top of Line 100-1 rather than some 9 m (30 ft) north of that line and outside of the TCPL right-of-way, as was intended. The most easterly of these two stakes is shown next to the crater on Figure A.2 and is marked as "REMAINS OF SURVEY STAKE".



Once the 4-inch sub-header tile run came to within about 3 m (10 ft) of that southernmost stake, Mr. Wright stopped the plow to allow Mr. Brasier to cut the tile at the top of the tile shoe and put in an end plug. Thus, there would be just enough tile left in the shoe to reach that stake once the plow moved forward. The blade of the plow, situated in front of the tile shoe, would at this time have been almost directly north of, and at the same depth as, Line 100-1.

While the tile work was proceeding, Mr. Burkholder was attempting to locate the second line on the westerly side of the field, south of his first staked line. As noted earlier, he had detected a signal in the area, and he proceeded to attempt to trace a line from that location. However, the locator signals being obtained were weak and, as a result, he did considerable backtracking. The evidence indicates that he placed two stakes during this attempted tracing.

During this tracing operation, Mr. Burkholder became aware of the plow's movement south (for the laying of the 4-inch sub-header). Occasionally glancing in that direction, he at one point looked over and saw a man whom he believed to be Mr. Wright (it was in fact Mr. Brasier) cutting the tile. However, believing the plow to still be 30 m (100 ft) or so back of his staked line, he returned to his locating activities. At this point he heard the plow's engine rev up and die down.

What was apparently happening at this time was that the plow was moving forward to lay the remainder of the 4-inch tile in its tile shoe. Almost instantly, the plow's blade caught and ruptured Line 100-1 (see Figure A.4). The rupture occurred at 1411 h EDT.

The force of the resultant explosion sent debris flying in all directions, and hurled the 30 tonne plow some 11 m (35 ft) southwards. Mr. Wright, who was thrown from the plow at that instant, was fatally burned in the explosion and fire.

Mr. Burkholder, with his back to the plow, was some 15 m (50 ft) west of his truck, and some 65 m (215 ft) to the west of the rupture site, when he heard the roar of the escaping gas. Turning around, he was partially blinded by the flying dirt but headed towards his truck, the engine of which was running. Once there, he threw the pipe locator receiver into the back of the truck and proceeded to leave the area. However, as he started to turn his truck away from the fire he saw a man (Mr. Brasier) stumble towards him. He stopped and assisted him into his truck, and made an exit to the south. Messrs. Duff and Peeters, both of whom were north of the rupture site at the time of the explosion, ran further to the north to escape the fire.

As Mr. Burkholder drove away from the site he attempted to call Station 130 on the radio in order to

report the accident, but was unsuccessful. He then proceeded to Mr. Guy's farmhouse to the south, where assistance was provided to Mr. Brasier.

Mr. Burkholder then drove out onto County Road No. 3, the road fronting Mr. Guy's farm, and contacted Station 130 to report the rupture and to request both the fire department and ambulance services. He then returned to the field and remained on-site.

Within minutes of the rupture W.J. Spicher, a police officer with the Durham Regional Police, driving in the vicinity called his headquarters to report the fire. The police station subsequently notified the fire department. Station 130 also called to advise the fire department.

Ambulance services arrived within 20 minutes of the rupture. Police investigating officers and the fire department also arrived on-site.

Upon TCPL's clerk receiving Mr. Burkholder's call alerting of the rupture, a station supervisor established a control centre at Station 130 to coordinate the implementation of the Company's emergency procedures. TCPL was able to isolate Line 100-1 on both the upstream and downstream sides of the rupture within 20 to 30 minutes of its occurrence.

The gas-fed fire lasted for some four hours before it burned itself out. At that time, the affected property was secured by the police.

On 17 and 18 October 1985, the accident was investigated by representatives from the following agencies:

- Durham Regional Coroner
- Durham Regional Police
- Ontario Fire Marshall's Office
- Ontario Ministry of Consumer and Commercial Relations
- Ontario Ministry of Labour
- TransCanada PipeLines Limited
- National Energy Board

The police were provided with two statements by Mr. Burkholder, the first on the day of the accident and the second on the following day. Mr. Peeters of Walker-Wright also provided a statement on 17 October 1985, the day of the accident. Owing to the severity of their injuries, Messrs. Duff and Brasier were not available to provide statements at that time; however, statements were eventually taken from them on 9 and 20 March 1986 respectively and they gave evidence at the NEB hearing.

## Injuries

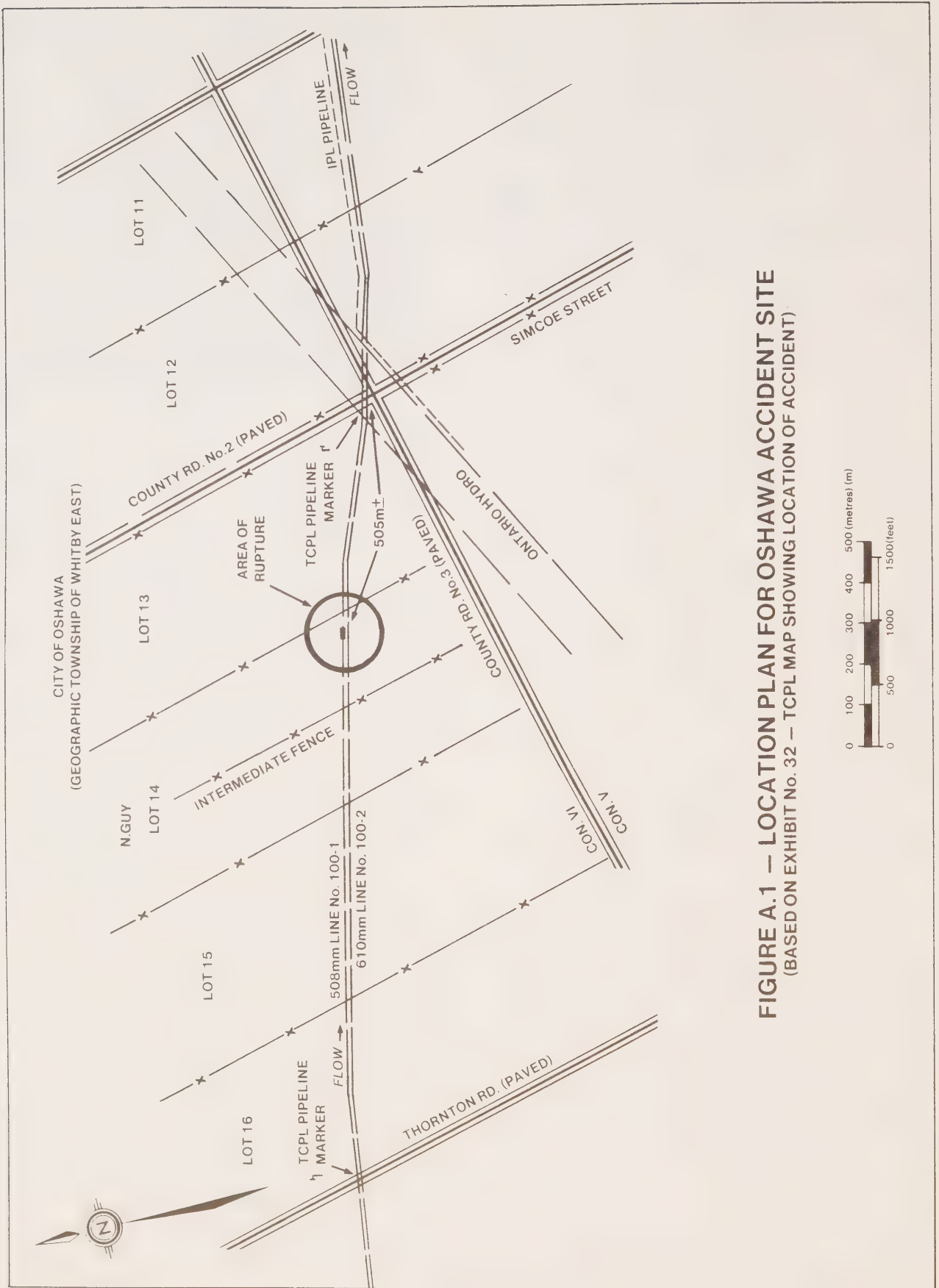
The following injuries were sustained as a result of the pipeline rupture:



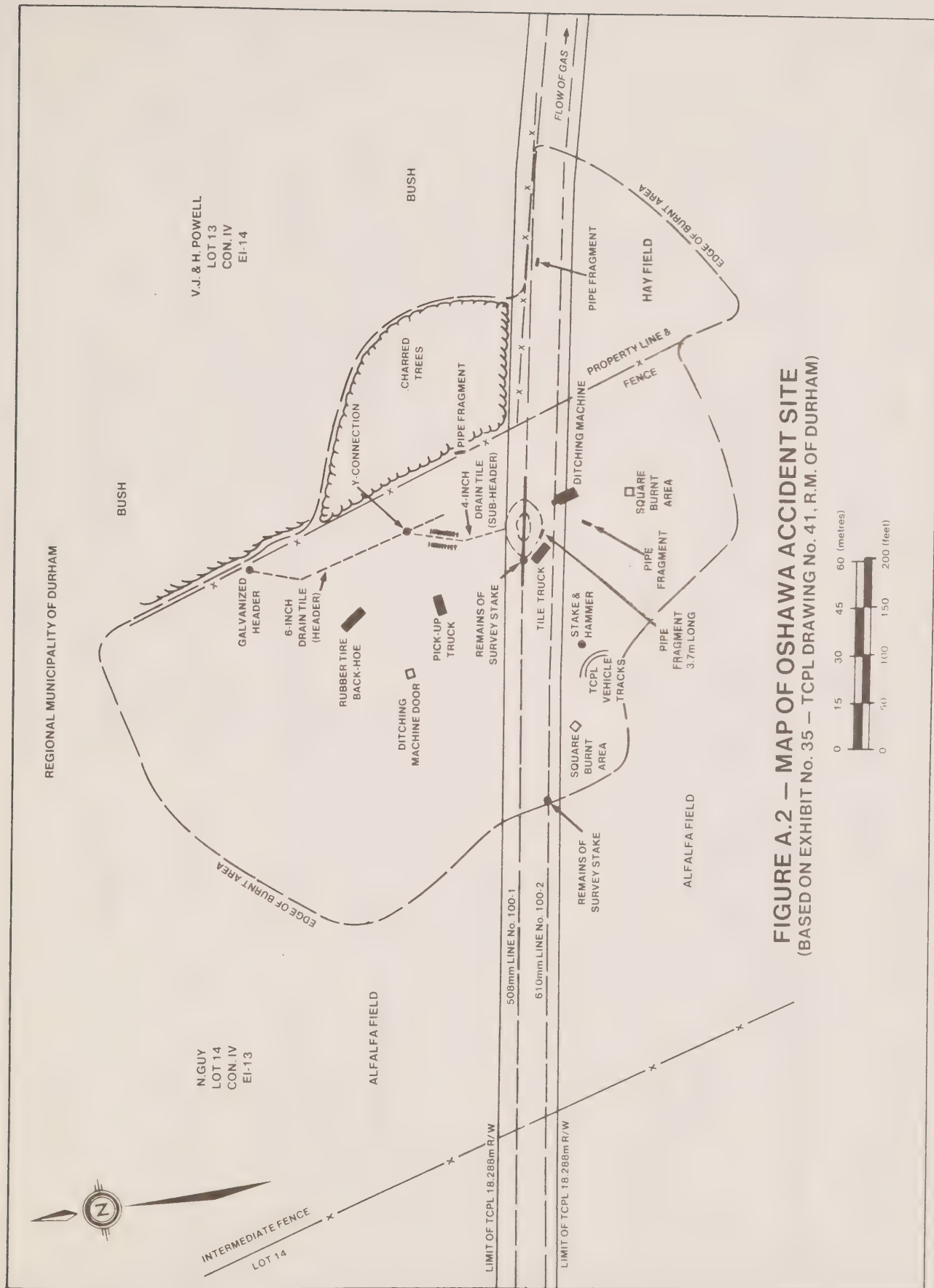
- Mr. Wright, the plow operator, died in the explosion and ensuing fire;
- Both Messrs. Brasier, the driver of the tile reel truck, and Duff, the backhoe operator, were severely burned and hospitalized;
- Mr. Peeters, a third member of the Walker-Wright crew, was also burned; and
- Mr. Burkholder of TCPL, who was further away from the rupture (65 m (215 ft) to the west), received minor burns.
- A pick-up truck, the tile reel truck, the rubber-tired backhoe, and the drainage tile plow, all of which were owned by Walker-Wright, were destroyed; and
- An 18.5 m (60 ft) long segment of TCPL's 508 mm (20 in) diameter Line 100-1 was destroyed, including some 12.5 m (40 ft) of which was blown out of the crater in fragments. A repair was effected by the installation of a replacement section of pipe some 35 m (115 ft) in length, and the line was returned to service at 1715 h EDST on 21 October 1985;
- An estimated  $878 \times 10^3 \text{ m}^3$  ( $31 \times 10^6 \text{ ft}^3$ ) of gas were lost from the ruptured pipeline;
- Some 2.3 ha (5.7 acres) of alfalfa were burned, as were some 0.26 ha (.63 acres) of bush.

### **Damages Sustained**

The following damages were sustained as a result of the accident:



**FIGURE A.1 — LOCATION PLAN FOR OSHAWA ACCIDENT SITE**  
 (BASED ON EXHIBIT No. 32 — TCPL MAP SHOWING LOCATION OF ACCIDENT)



**FIGURE A.2 — MAP OF OSHAWA ACCIDENT SITE**  
 (BASED ON EXHIBIT No. 35 — TCPL DRAWING No. 41, R.M. OF DURHAM)

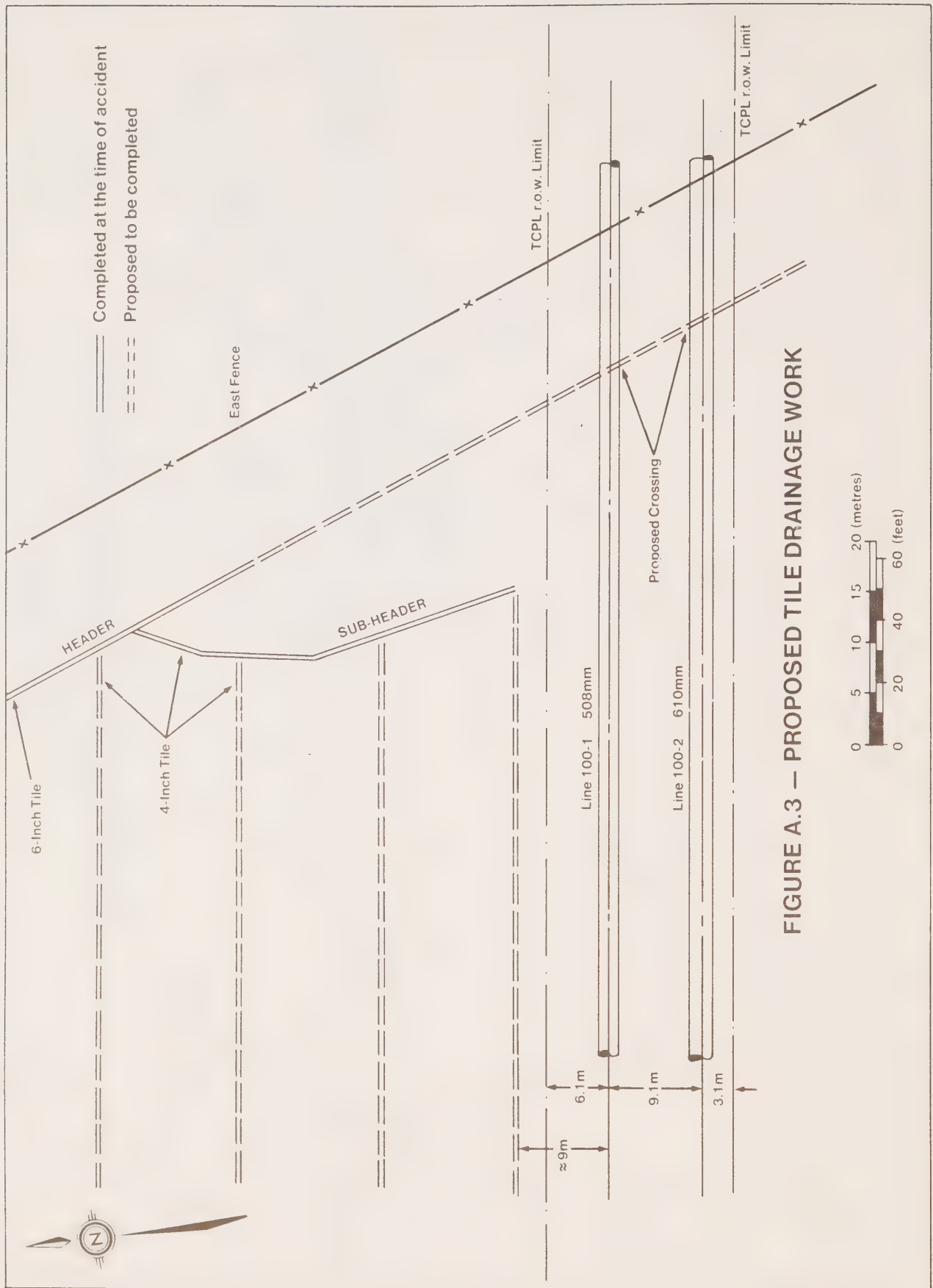
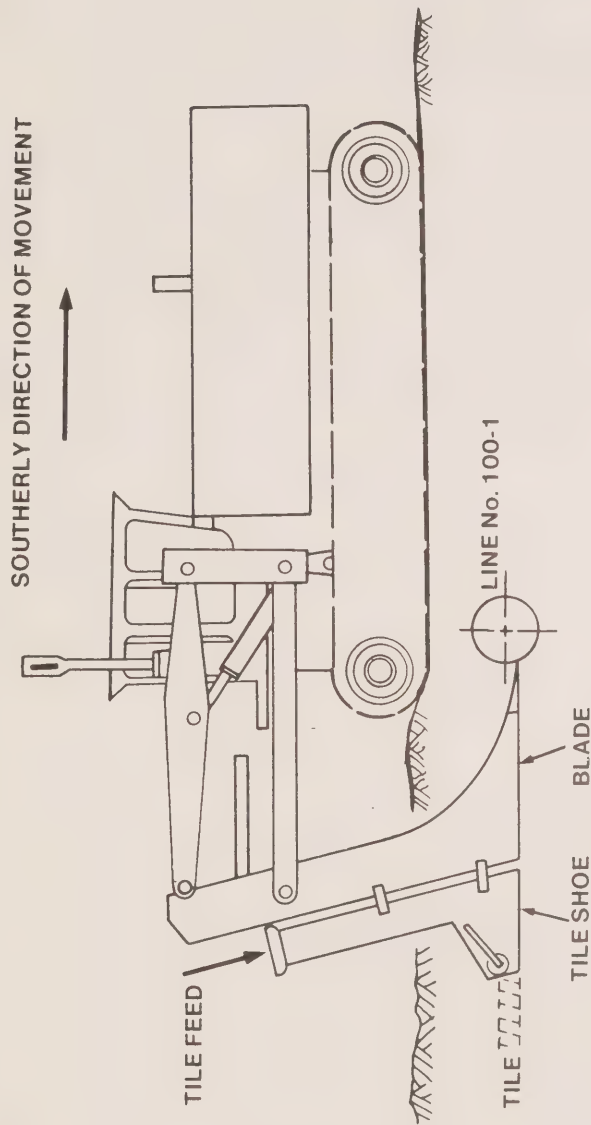


FIGURE A.3 — PROPOSED TILE DRAINAGE WORK





**FIGURE A.4 — PROBABLE POSITION OF DRAINAGE PLOW, BLADE AND TILE AT THE INSTANT OF THE OSHAWA LINE BREAK**

(BASED ON FIGURE 18 OF EXHIBIT NUMBER 11 — TCPL LETTER DATED 7 APRIL, 1986  
WITH ATTACHED WELDING INSTITUTE OF CANADA REPORT M602/3/86, OSHAWA LINE BREAK)





## Appendix B

### Hearing Participants

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#### **TransCanada PipeLines Limited**

Counsel: T. McGrenere  
C.C. Black

Witnesses Called:

P.H. Burkholder TransCanada PipeLines Limited  
A. Harkes TransCanada PipeLines Limited  
G.W.F. Evoy  
M. Durnin

#### **National Energy Board**

Counsel: H. Soudek

Witnesses Called:

R. Walker Walker-Wright Drainage Limited  
Det. J. Adams Durham Regional Police  
N. Guy Landowner  
K. Brasier Walker-Wright Drainage Limited  
G. Duff Walker-Wright Drainage Limited  
R. Peacock Durham Regional Police

#### **Intervenors**

##### **Mr. Roy Walker**

Counsel: B. Doherty

##### **Family of the Late Mr. Donald Wright**

Counsel: B. Doherty

##### **Ontario Ministry of Energy**

Counsel: J. Pounder

##### **Mr. Charles Lamb**

On his own behalf

##### **Ontario Farm Drainage Association**

Represented by D. Inglis, President





# Appendix C

## General Order No. 2 Respecting Standard Conditions for Crossings of Pipelines (National Energy Board, 14 December 1978)

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### Short Title

1. This Order may be cited as General Order No. 2. Before the Board on Thursday the 14th day of December 1978.

Pursuant to the powers vested in the Board by the National Energy Board Act,

### IT IS ORDERED THAT:

2. The conditions hereinafter set forth be, and they are hereby made and adopted respecting the construction of a highway, private road, railway, irrigation ditch, drain, drainage ditch, sewer, telegraph or telephone line or a line for the transmission of hydrocarbons, power or any other substance across any pipeline in place and instead of the conditions set forth in General Order No. 2 issued by the Board on the 21st day of July 1961 and which is hereby revoked, except from applications for leave under section 77 which are received by the National Energy Board on or before the first day of January 1979.
3. Every Order of the Board granting leave under Section 77 of the National Energy Board Act shall be deemed to be leave upon the conditions hereinafter set forth, which conditions shall be deemed to be included in any such Order without specific reference thereto, subject, however, to such change or variation therein as may be set forth in such Order.

### Interpretation

4. In this Order,
  - (a) "Board" means the National Energy Board;
  - (b) "highway" includes any public road, road allowance, street, lane or other public way;
  - (c) "pipeline" means a line for the transmission of gas or oil connecting a province with any other or others of the provinces, or extending beyond the limits of a province, and includes all branches, extensions, tanks, reservoirs, storage facilities, pumps, racks, compressors, loading facilities, interstation systems of communication by telephone, telegraph

or radio, and real and personal property and works connected therewith; and

- (d) "utility" means an irrigation ditch, drain, drainage ditch, sewer, telegraph or telephone line or a line for the transmission of hydrocarbons, power or any other substance.

### Applications

5. Before constructing a highway, private road, railway or utility across any pipeline, the party proposing to do so (hereinafter called "the Applicant") shall apply to the Board for leave to carry the highway, private road, railway or utility across such pipeline and, upon such application shall file
  - (a) a description of the location of the proposed crossing including a geographical reference sufficiently detailed so that the crossing can be located on a map, and
  - (b) four sets of a combined drawing of the proposed crossing, which shall include
    - (i) a location plan having a scale of 1:10 000 or other approved scale, which shall show clearly the location described in paragraph (a), the angle of the crossing and, in surveyed territory, the distance from the crossing to the nearest lot or section line measured along the centre line of the pipe or, in unsurveyed territory, the distance from the crossing to the nearest major physical feature such as a river, highway, etc., measured along the said centre line;
    - (ii) a plan having a scale of 1:1 000 or less showing all details pertinent to the crossing which shall, without limiting the generality of the foregoing, include, except in the case of overhead wire crossings, the anticipated maximum working pressure, the field test pressure and the mill test pressure of both the crossed and crossing carrier pipe or

pipes together with specifications including the wall thickness and outside diameter of the carrier and casing pipe where required, and in the case of highway and private road crossings, the maximum wheel load allowed by the relevant authority;

- (iii) detailed and dimensioned drawings of the longitudinal profiles along the centre lines of the pipelines and along the centre line of the highway, private road, railway or utility and a cross-section of the highway, private road, railway or utility at the intersection of the centre line of the highway, private road, railway or utility and of the centre line of the pipeline right-of-way, all having a scale of

1:200 horizontal      1:100 vertical, and

the drawings shall show all clearances in respect to the line or lines of the Company at the crossing.

- 6. The Applicant shall serve a true copy of the application and a true copy of the combined crossing drawing upon the authority having control over the pipeline to be crossed or to the owner of such pipeline as the case may be. Unless otherwise directed by the Board, the service required by this section may be made by prepaid registered post.
- 7. Any dispute between the parties as to the application of these conditions in a particular case may be referred in writing by either party to the Chief Engineer of the Board or to the person acting as such, whose decision may within 16 days after the date of making thereof be appealed to the Board.

### **Conditions**

#### **Crossings of Pipelines by a Highway, Private Road, Railway or Utility**

- 8. The following general conditions shall apply to all crossings of pipelines by a highway, private road, railway or utility:
  - (1) (a) In the case of the crossing of either a gas or an oil pipeline by a highway, private road, railway or utility, the pipeline at the proposed crossing shall, except as otherwise provided herein, conform with the respective specifications and requirements of the current CSA STANDARD Z183 and CSA STANDARD Z184

and if, at the place of crossing, the pipeline does not conform, the crossing may be made only if the pipeline is reconstructed to conform to such requirements at such place.

- (b) The carrier pipe under highways or private roads shall in all cases be of sufficient strength to withstand safely all stresses and strains resulting from its location and the operating conditions of the pipeline and, unless the Board approves a lesser width in the case of highways, shall extend at that strength the full width of the proposed right-of-way.
- (2) If the Applicant's works being installed at or near the pipeline crossing may in any way affect the cathodic protection of the pipeline, the authority having control over or the owner of the pipeline as the case may be, shall so notify the Applicant in writing so that concurrent tests may be made and remedial measures, where necessary, agreed upon.
- (3) At any crossing of a pipeline, except crossings by overhead telephone, telegraph or power lines, the pipeline shall be identified by markers approved by the Board. Such markers shall be placed whenever possible approximately on the limits of the Applicant's right-of-way or such other places as may be approved by the Board.
- (4) A utility below ground level shall cross under a pipeline unless otherwise approved by the Board and a clearance of not less than 0.3 m shall be maintained at the point of crossing between the utility and the pipe and all other underground structures.
- (5) A highway or private road shall be so constructed that the travelled surface thereof shall be not less than 1.3 m above the top of the carrier or casing pipe where casing is required, nor shall the bottom of the ditches be less than 0.8 m above the top of the said carrier or casing pipe; provided that where it is not practicable to obtain the above-mentioned clearances special construction shall be necessary which construction shall be subject to the approval of the Board.
- (6) The construction of the crossing shall be carried out in a good and workmanlike manner as quickly as possible and with due precautions for the safety and convenience of the public.

- (7) All work in connection with the construction, maintenance, renewal, repair and removal of the crossing and the continuing supervision of the same shall be performed by the Applicant and, unless the renewal, repair or removal is made necessary by reason of the negligence of others, all costs and expenses of such work shall be borne and paid by the Applicant and no work shall at any time be done in such a manner as unduly to interfere with, obstruct, delay or interrupt the operation of the pipeline.
  - (8) The Applicant shall at all times maintain the crossing in good working order and condition, so that no damage is caused to the pipeline nor its usefulness or safety impaired, nor the full use and enjoyment thereof in any way interfered with.
  - (9) Notwithstanding the provisions of subsection (7), all work consisting of realigning, raising or lowering the pipeline or excavating material from under, over or around it, or the addition of casing or other appurtenances thereto, shall be performed by the authority having control over or the owner of the pipeline, as the case may be, and all costs and expenses of such work including any justifiable economic losses resulting from any shutdown of the pipeline or any other consequential loss directly attributable to such work shall be borne and paid for by the Applicant.
  - (10) Before any work of constructing, renewing, repairing or removing any crossing of a pipeline is begun, the Applicant shall give to the authority having control over or the owner of the pipeline, as the case may be, at least 48 hours notice thereof in writing; provided that in an emergency the appropriate official of the pipeline shall be notified immediately, in order that in every case the authority having control over or the owner of the pipeline, as the case may be, may appoint an Inspector to ensure that the work is performed in a satisfactory manner.
  - (11) The amount of the wages and expenses of an Inspector appointed under subsection (10) hereof shall be paid by the Applicant upon receipt from the pipeline company of a statement showing in reasonable detail the particulars of such wages and expenses.
  - (12) If an Applicant intends to abandon a crossing, it shall give to the Board and to the authority having control over or the owner of the pipeline, as the case may be, at least 60 days prior written notice of its intention so to do and no such crossing shall in fact be abandoned until after the expiration of the 60 days above referred to.
  - (13) The Applicant shall upon the abandonment of a crossing restore the site to substantially the same condition as existed prior to the construction of the said crossing unless otherwise permitted by the Board.
9. The following particular conditions shall also apply to the crossing of a pipeline by important highways, designated as such by the appropriate highway authority:
- (1) Important highways shall be located so as to cross a pipeline at an angle as close as practicable to ninety (90) degrees but not less than forty-five (45) degrees, but where it is not practicable to cross within the above angle limits, the Board may give such special directions including directions respecting costs as may be necessary.
  - (2) The carrier pipe shall be encased in a metal casing pipe or conduit of sufficient strength to withstand safely all stresses and strains resulting from its location and the operating conditions of the pipeline, and unless the Board approves a lesser width, the casing pipe shall extend at that strength the full proposed width of the highway right-of-way.
  - (3) Before encasement, the carrier pipe shall be coated and wrapped in accordance with normally accepted practice designed to provide proper corrosion protection for the said carrier pipe.
  - (4) The ends of the casing pipe shall be properly sealed to the outside of the carrier pipe and the annular space between the pipes shall be properly vented above the ground with vent pipes not less than 50 mm in diameter and extending not less than 1.3 m above the ground surface.
  - (5) Vent pipes shall be
    - (a) located on each side of the proposed highway right-of-way approximately on the limits thereof;
    - (b) connected with the casing pipe approximately 0.3 m from the ends thereof;
    - (c) fitted at the top with a screened turn-down elbow or other screened capping device as approved by the Board; and



- (d) identified by markers approved by the Board.
- (6) The casing pipe shall be of sufficient size to permit its installation in a straight line and without damage to the carrier pipe, its coating or its wrapping.
- (a) Where the diameter of the carrier pipe is less than 150 mm, the nominal outside diameter of the casing pipe shall be at least 50 mm greater than the nominal outside diameter of the carrier pipe, joints or couplings and, where the diameter of the carrier pipe is 150 mm or more, the nominal outside diameter of the casing pipe shall be at least 100 mm greater than the said diameter of the carrier pipe, joints or couplings.
- (b) The clearance between the carrier and casing pipes shall, in all cases, be sufficient to permit the carrier pipe to be removed without disturbing the casing pipe or the structure of the highway crossing it.
- (c) The casing pipe shall be installed with an even bearing throughout its length in such a manner as to prevent formation of a waterway along it and shall be constructed so as to prevent leakage of any matter from the casing throughout the entire length thereof except through vent pipes.
- (d) Carrier pipes having a diameter of 75 mm or more shall be held clear of the casing pipe by properly designed supports, insulators or centering devices so installed that no loads from the roadbed or traffic will be transmitted to the carrier pipe.
- (e) The casing pipe shall be installed so that the carrier pipe is centered therein and shall be properly electrically insulated from the said carrier pipe.
- (7) After installation of the casing around the carrier pipe the trench shall be backfilled with suitable material properly compacted in layers in order that lateral resistance may be maintained against the pipe or casing walls.
- (8) The Board may exempt an Applicant from compliance with the provisions of this Order respecting the use of casing pipes and may approve the construction of uncased crossings upon submission by the Applicant of such proper plans, details and specifications as the Board may order.
10. The following particular conditions shall also apply to the crossing of a pipeline by railways:
- (1) Subject to subsection (2) railway tracks shall be located to cross pipelines at an angle as close as practicable to ninety (90) degrees but not less than forty-five (45) degrees.
- (2) The Board may require the pipeline to be relocated to obtain the crossing angles required by subsection (1) and where the Board so orders, any justifiable economic losses resulting from any necessary shut-down together with all other costs directly attributable to such relocation shall be borne and paid for by the Applicant.
- (3) The carrier pipe shall be encased in a metal casing pipe or conduit of sufficient strength to withstand safely all stresses and strains resulting from its location and the operating conditions of the pipeline.
- (4) The casing required by subsection (3) shall extend a minimum distance of 15 m from the centre line on each side of the single track to be installed or 15 m beyond the centre line of outside track, measured at right angles thereto or for such additional distance as may be required in any particular case; provided that in the case of tracks other than main tracks the distance of 15 m may be reduced to a minimum of 10 m.
- (5) Before encasement, the carrier pipe shall be coated and wrapped in accordance with normally accepted practice designed to provide proper corrosion protection for the said carrier pipe.
- (6) The ends of the casing pipe shall be properly sealed to the outside of the carrier pipe and the annular space between the pipes shall be properly vented above the ground with vent pipes not less than 50 mm in diameter and extending not less than 1.3 m above the ground surface.
- (7) Vent pipes shall be
- (a) located on each side of the proposed railway right-of-way approximately on the limits thereof;
- (b) connected with the casing pipe approximately 0.3 m from the ends thereof;



- (c) fitted at the top with a screened turn-down elbow or other screened capping device as approved by the Board; and
  - (d) identified by markers approved by the Board.
- (8) The casing pipe shall be of sufficient size to permit its installation in a straight line and without damage to the carrier pipe, its coating or its wrapping.
- (a) Where the diameter of the carrier pipe is less than 150 mm, the nominal outside diameter of the casing pipe shall be at least 50 mm greater than the nominal outside diameter of the carrier pipe, joints or couplings and, where the diameter of the carrier pipe is 150 mm or more, the nominal outside diameter of the casing pipe shall be at least 100 mm greater than the said diameter of the carrier pipe, joints or couplings.
  - (b) The clearance between the carrier and casing pipes shall, in all cases, be sufficient to permit the carrier pipe to be removed without disturbing the casing pipe or the structure of the railway crossed.
  - (c) The casing pipe shall be installed with an even bearing throughout its length in such a manner as to prevent formation of a waterway along it and shall be constructed so as to prevent leakage of any matter from the casing throughout the entire length thereof except through vent pipes.
  - (d) Carrier pipes having a diameter of 75 mm or more shall be held clear of the casing pipe by properly designed supports, insulators or centering devices so installed that no loads from the roadbed, track or traffic will be transmitted to the carrier pipe.
  - (e) The casing pipe shall be installed so that the carrier pipe is centered therein and shall be properly electrically insulated from the said carrier pipe.
- (9) After installation of the casing around the carrier pipe the trench shall be backfilled with suitable material properly compacted

in layers in order that lateral resistance may be maintained against the pipe or casing walls.

- (10) The Board may exempt an Applicant from compliance with all or any of the provisions of this Order respecting the use of casing pipes and may approve the construction of uncased crossings upon submission by the Applicant of such proper plans, details and specifications as the Board may order.
- (11) Railway crossings shall be constructed so as to allow a minimum clearance respectively between the top of the casing pipe and the base of the rail of 2 m and of 1 m between the top of the casing pipe and the bottom of the railway right-of-way ditch and/or natural ground surface; provided that in the case of tracks other than main tracks the afore-mentioned depths of 2 m and 1 m may be reduced to 1.3 m and 0.8 m respectively.
- (12) Whenever the pipeline to be crossed is cathodically protected, the authority having control over or the owner of such pipeline, as the case may be, shall so notify the Applicant in writing so that concurrent tests may be made and remedial measures where necessary agreed upon.

### Indemnity

- 11. The Applicant shall, from time to time and at all times hereafter, well and truly save, defend and keep harmless and fully indemnify the authority having control over or the owner, from time to time, of the pipeline, as the case may be, from and against all loss, costs, damage, injury and expense to which the said authority or owner may at any time or times hereafter be put by reason of any damage or injury to persons or property caused by the construction, maintenance or operation of the Applicant's works, as well as against any damage or injury resulting from the negligence, imprudence, neglect or want of skill of the employees or agents of the Applicant in connection with the construction, maintenance, operation, renewal, repair, abandonment or removal of the said Applicant's works, unless the cause of such loss, costs, damage, injury or expense can be traced elsewhere.







